

BRYOZOAN FOULING ORGANISMS FROM OAHU, HAWAII  
WITH A NEW SPECIES OF *WATERSIPORA*DOROTHY F. SOULE<sup>1</sup> AND JOHN D. SOULE<sup>2</sup>

## INTRODUCTION

During the course of an extensive study of the bryozoans of the Hawaiian Islands, particular note was made of a relatively few species which generally constitute the bryozoans in the fouling communities in many locations there. On the island of Oahu, the authors made collections at Kaneohe Bay from fixed and floating docks, from rafts, from suspended metal test panels, and from glass slides which were mounted in screened racks and hung at various depths. Boat hulls were scraped there and also at Ala Wai Yacht Harbor, where collecting was done as the boats were being raised for drydocking at Ala Wai Marine, Ltd. To the above information has been added data on the fouling species identified by the authors from the University of Hawaii collections and from the Bernice P. Bishop Museum collections. Much of the material from these latter sources lacks accurate collecting data, however.

Members of the bryozoan phyla (Entoprocta and Ectoprocta) are among the most common fouling organisms, particularly during the warmer months of the year. Throughout the world some 150 species are known which foul ships' hulls, buoys, floats and test panels (Hutchins, 1952). At times the bryozoans may constitute nearly 100 percent of the fouling organisms on a given surface.

On Oahu, thirteen species were found repeatedly, though in varying quantities, on harbor installations and boats. One frequently collected form, which at first was included in *Watersipora cucullata* (Busk), has been designated a separate new species *Watersipora edmondsoni*

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in honor of Charles Howard Edmondson, who pioneered in efforts to identify the rich reef and shore fauna in Hawaii.

The harbor areas investigated in this study offer diverse exposures, water conditions, and shipping traffic on Oahu. Kaneohe Bay is located on the windward northeast coast, bound on the south by Mokapu Peninsula and on the north by Kuloa Point. The bay is shallow, much of it five fathoms or less; boat traffic is largely local fishing boats and pleasure craft. In recent years the bay has been subject to a greater than normal freshwater and soil runoff, due to extensive subdivision along the southwest shore. A freshwater lens often forms on the bay following heavy rains, which are common during the winter months. Pollution from shipping or industry is not a problem, as compared with Honolulu or Pearl Harbors. The runoff has however greatly increased growth of the bluegreen algae *Phormidium crosbyanum*, which forms large green blisters or globes on much of the shallow bay floor. Relatively low influx of sewage is rising, adding phosphate (Bathen, 1968).

The University of Hawaii marine laboratory is located in the southern portion of Kaneohe Bay on Moku O Loe Island (Coconut Island); many collections for the present study were made there. Edmondson and Ingram (1939) reported on fouling organisms in Hawaii, primarily from Kaneohe Bay, and identified six species of bryozoans in their study: *Bugula neritina*, *Zoobotryon pellucidus*, *Aetea truncata*, *Catenaria lafonti*, *Rhynchozoon nudum*, *Schizoporella unicornis*, plus *Amathia*, sp.

Ala Wai Yacht Harbor is a pleasure boat anchorage on the south coast of Oahu, east of Honolulu Harbor. Ala Wai Canal, a major fresh water drainage channel, empties into the ocean at the harbor. Houseboats, which had been anchored only in the local basin for several years prior to drydocking, were selected for collection of specimens. Some of the hulls were completely carpeted with fouling organisms, with bryozoans constituting by far the major portion of the surface organisms. Specimens were scraped alive from the hulls and placed immediately in buffered formalin or isopropyl alcohol.

On the hulls incrusting species provide a surface layer to which other organisms apparently then attach. The soft-bodied ctenostomes form trailing masses 20 to 25 cm in length, or when mixed with firmer branching cheilostomes form a thick feltwork. These growths in turn provide shelter for numerous small crustaceans, polychaetes, young mollusks, tunicates, and algae.

Fouling at Pearl Harbor was discussed by Edmondson (1944), but only two species of bryozoans were mentioned: the common *Bugula*

*neritina* and *Schizoporella unicornis*. Pearl Harbor, an improved deep water harbor with a single entrance, receives considerable freshwater runoff from half a dozen streams and drainage outlets and is extensively polluted by shipping and industry.

Honolulu Harbor is a much smaller harbor with two entrances and two major stream-drainage outfalls. It has much commercial shipping traffic. Although little collecting was done at Pearl or Honolulu Harbors by the authors, they are represented by a wealth of material in the Bishop Museum collections from those sites. An extensive study of bryozoans is still underway at the leeward west end of Oahu, at Pokai Bay.

This project is supported in part by National Science Foundation Grants GB 5208 and 7723. The cooperation of Drs. Sidney Townsley and Philip Helfrich of the University of Hawaii has been invaluable and is greatly appreciated. The rafts and steel plates in Kaneohe Bay from which our traps were suspended were a part of a project supported by Lockheed Corporation, and were made available through Mr. James McVey and Dr. Ernest Littauer. The Bernice P. Bishop Museum collections were made available through the kindness of Drs. Lucius Eldredge and Dennis Devaney. Eve Myers and Pete Arapoff were most helpful in arranging for the authors to collect from hulls known to be from local waters as they were freshly exposed on being raised for dry-docking at Ala Wai Marine, Ltd.

#### FOULING BRYOZOANS OF OAHU

##### Phylum Entoprocta

*Barentsia gracilis* (M. Sars), 1835

##### Phylum Ectoprocta

###### Order Ctenostomata

*Amathia distans* Busk, 1886

*Bowerbankia gracilis* Leidy, 1855

*Bowerbankia imbricata* (Adams), 1800

*Zoobotryon verticillatum* (delle Chiaje), 1828

###### Order Cheilostomata, Suborder Anasca

*Aetea truncata* (Landsborough), 1852

*Bugula californica* Robertson, 1905

*Bugula neritina* (Linnaeus), 1758

*Scrupocellaria sinuosa* Canu and Bassler, 1927.

###### Order Cheilostomata, Suborder Ascophora

*Hippopodina feegeensis* (Busk), 1884

*Savignyella lafonti* (Audouin), 1826*Schizoporella unicornis* (Johnston), 1847*Watersipora edmondsoni* new species

KEY TO THE FOULING BRYOZOANS  
OF OAHU, HAWAII

1. a) Colony recumbent, stolonate ..... (2)
- b) Colony incrusting or erect; not stolonate ..... (7)
2. a) True stolons formed by modified  
    individuals lacking aperture or  
    tentacles; non-calcareous ..... (3)
- b) False stolons formed by expansion of the  
    bases of normal individuals; calcareous  
    (Ectoprocta, Cheilostomata) ..... *Aetea truncata*
3. a) Normal feeding individuals consisting of  
    stalk (pedicel) and head (calyx), with  
    joints (Entoprocta) ..... *Barentsia gracilis*
- b) Individuals not consisting of stalk  
    and calyx; sacciform (Ectoprocta) ..... (4)
4. a) Individuals arranged spirally in pairs  
    biserially around distal part of  
    each stolon segment ..... *Amathia distans*
- b) Individuals not in biserial spirals ..... (5)
5. a) Individuals arranged bilaterally along  
    stolon with occasional clusters;  
    no caudal projections ..... *Zoobotryon verticillatum*
- b) Individuals single or in pairs or clusters;  
    some with caudal projection ..... (6)
6. a) Polypide with ten tentacles ..... *Bowerbankia imbricata*
- b) With eight tentacles ..... *Bowerbankia gracilis*
7. a) Colony erect, branching ..... (8)
- b) Colony forming flat crusts ..... (11)
8. a) Colony with branches formed of biserial  
    rows of individuals; no joints;  
    frontal uncalcified ..... (9)
- b) Colony with branches formed of alternate  
    individuals; with joints; frontal with  
    shield or calcified ..... (10)
9. a) Colony bushy, reddish brown. No spines  
    or avicularia (pincers). Ovicells  
    large, set diagonally proximally ..... *Bugula neritina*

- b) Colony whitish; individuals with three spines at distal corners, large and small avicularia on side walls; ovicells globular, centered ..... *Bugula californica*
- 10. a) Colony fragile, whitish; seven individuals to a segment, with light colored joints; uncalcified frontal with an oval shield (scute) raised over frontal from one rim ..... *Scrupocellaria sinuosa*
- b) Colony branched or spreading, bright red; individuals uniserial, jointed, trumpet-shaped; frontal calcified with six spines around aperture ..... *Savignyella lafonti*
- 11. a) Lightly calcified; with ovicell and frontal perforate; aperture hoof-shaped, rounded distally ..... *Hippopodina feegeensis*
- b) More heavily calcified; frontal perforate; aperture with a notch (sinus) or curve in proximal edge ..... (12)
- 12. a) Avicularium on one or both sides of aperture; aperture with proximal notch; large perforate ovicell above aperture ..... *Schizoporella unicornis*
- b) No avicularia, ovicell internal (endozoecial); aperture with sinus, cardelles at corners, ovoid; operculum with dark brown center pillar and rim; colony orange-brown to light tan ..... *Watersipora edmondsoni*

*Aetea truncata*. Tiny stolon-like colonies wander across irregular surfaces and over other bryozoans. From the stoliform base, each individual raises an erect rough tube which has an uncalcified frontal membrane and an operculum at the distal, head end. *A. truncata* is straight across at the distal tip, as though clipped off. Other species of *Aetea* have wrinkled erect tubes and spoon-shaped heads.

*Aetea truncata* (Pl. 1, Fig. 6) was reported by Edmondson and Ingram (1939) in the fouling community at Kaneohe Bay, but its importance was discounted because of its negligible vertical growth. However it is often the initial colonial organism to occupy a substratum, the tubules providing surface irregularities for other organisms to colonize, and it is thus significant. *A. truncata* is represented in the

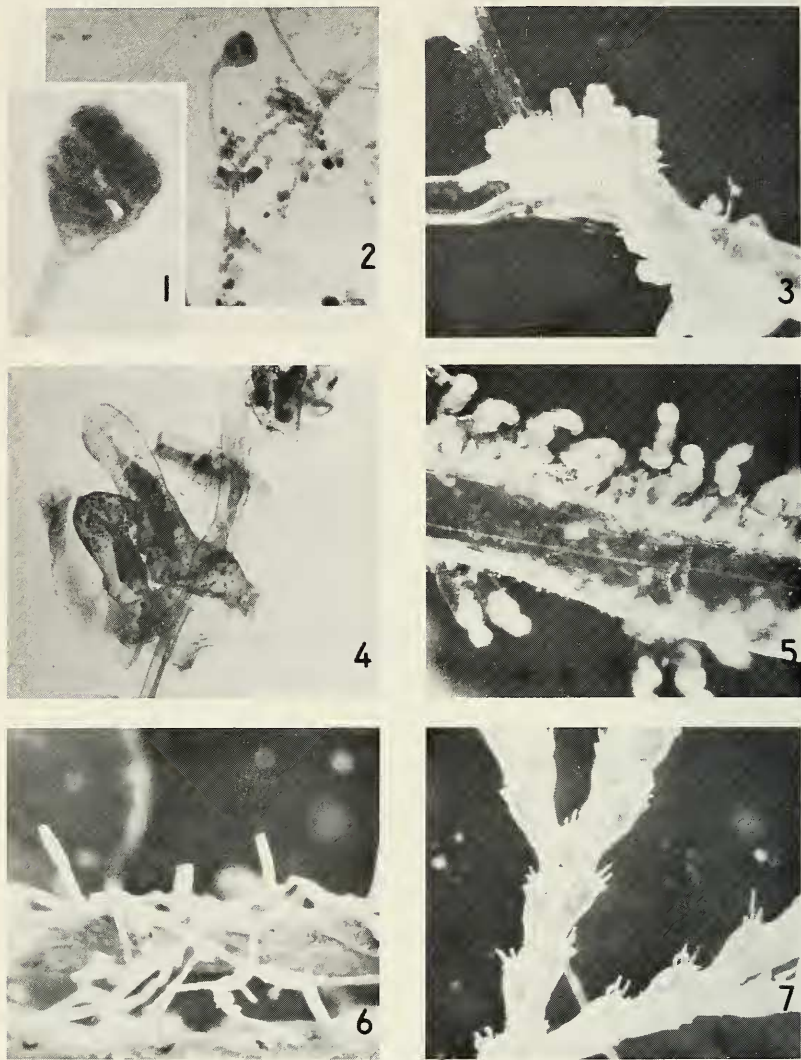


Plate 1.

Figure 1. Calyx of *Barentsia gracilis*; note tentacles curled on face of calyx.

Figure 2. *Barentsia gracilis*, showing expanded base, pedicel and calyx.

Figure 3. *Amathia distans*; note spiral arrangement of zooids around stolon.

Figure 4. *Bowerbankia*, sp. Zooecia showing subterminal attachment to stolon, caudal protrusions.

Figure 5. *Zoobotryon verticillatum*; note wide stolon and small zooecia distributed bilaterally.

Figure 6. *Aetea truncata*, portion of colony showing erect individuals.

Figure 7. *Scrupocellaria sinuosa*; note spines and scute over the frontal area.

Bishop Museum collections, from Kaneohe Bay, from Honolulu Harbor, and "off Oahu" at 9.1 and 27.4 m depths; collected in December, January, June and September with no other seasonal or locality data given.

Collected by the authors in July and August 1966, at Kaneohe Bay; common on glass slides suspended in screened settling traps at 3.05 m depth. Water temperature, 26° to 28° C. *Aetea truncata* is widely distributed in cool temperate to tropical waters around the world (Osburn, 1950).

*Amathia distans*. Extensive, soft, trailing colonies are formed by biserial rows of small plump tubular zooecia which spiral around the distal portion of each stolon segment. Apertures are terminal, squared, open. The soft matted masses of the colonies host many small invertebrates. Edmondson and Ingram discounted the species as a fouling organism of importance because it presumably would break off a boat hull underway. However interisland barge traffic is rather slow moving, and the colonies seem to form shorter, more dense growths on such hulls. *Amathia* colonies also are sometimes found interwoven with more rigid bryozoan species such as *Bugula californica*, giving firmness to the soft-bodied growths.

*Amathia distans* (Pl. 1, Fig. 3) was collected at the University of Hawaii marine laboratory fixed and floating docks at a depth of 0.3-0.6 m at Coconut Island in Kaneohe Bay. It is represented in 18 lots of the Bishop Museum collections, taken from Kaneohe Bay, Honolulu Harbor, and Pearl Harbor, and off Ft. DeRussy. Every month of the year is represented in the collections except March and October. Found also in the University of Hawaii collections. *A. distans* has been reported from the south Atlantic, Australian waters, Java, Puerto Rico, Puget Sound, and from southern California and the Gulf of California (Osburn, 1953; Soule, 1963).

*Barentsia gracilis* (Entoprocta) (Pl. 1, Figs. 1, 2). The only entoproct as yet identified to species level in the Hawaiian collections is small and delicate, with long stolons which extend over smooth surfaces or creep in about hydroids and other bryozoans. Individuals consist of a stalk with basal swelling and joints, and with a cup-shaped calyx which hangs to the side with tentacles extended. *Barentsia gracilis* was collected by the authors at Kaneohe Bay, growing on the fixed dock on stolons of *Amathia*, and also on glass slides suspended in screened traps at 3.05 and 6.1 m depths. Because the species is so small and inconspicuous it has been discounted as a fouling organism. However it was the first organism to colonize the smooth glass surface of many of the slides, and would thus furnish larger organisms with a roughened

substratum. Although *B. gracilis* was not found in the Bishop Museum collections, it is probably more common than might be thought and is overlooked because of its small size. It requires immediate preservation for identification. This species is worldwide in distribution, according to Harmer (1915), and Osburn (1953).

*Bowerbankia gracilis*. A ctenostome, this species forms a colony which is a tangled mass of trailing stolons bearing individual zooecia singly, in pairs, or in clusters. It is often covered with algae and entangled with other bryozoans. *Bowerbankia gracilis* has eight tentacles, determined by sectioning, as do many species of *Bowerbankia*.

*Bowerbankia gracilis* was identified from boat hulls in the Ala Wai Yacht Basin in July and August, mixed with *Bugula californica* and *Bugula neritina* as well as other ctenostomes. Also found on the undersides of the floating docks at the University of Hawaii marine station, at depths of 0.3-0.6 m in July and August.

*Bowerbankia imbricata*. The colony is a tangled mass of stolons with individuals clustered or not. This species has ten tentacles, determined by sectioning, which distinguishes it from other species of *Bowerbankia* with certainty. The stolons are generally thicker than those of *B. gracilis*, with which it is often intertwined.

*Bowerbankia*, sp. was collected on suspended glass slides at 3.05 and 6.1 m depths, but the colonies were small and were not sectioned. It was also identified in four lots of the Bishop Museum collections, taken from Kaneohe Bay, Pearl Harbor, and Honolulu Harbor in January, February and May. This latter material was not well enough preserved to section and make tentacle counts for species identifications.

Prenant and Bobin (1956) indicate that there has been great confusion in the past over the identification of the species of *Bowerbankia*. The distribution record indicate that *B. gracilis* is a cosmopolitan species. *B. imbricata* has been more frequently reported from cooler waters, but is known from the Red Sea, Japan and the Indo-Pacific (Osburn, 1953; Prenant and Bobin, 1956), in marine and brackish waters (*Bowerbankia*, sp. Pl. 1, Fig. 3).

*Bugula californica*. This species forms a whitish, branching and bushy, unjointed colony and is often found mixed with hydroids, other bryozoans and algae on dock pilings. *B. californica* is easily distinguished by having biserial branches, globular ovicells centered distally, two or three short spines at the distal corners, and raised, "birds-head" avicularia along the side walls. *Bugula* species bud from the dorsal, distal end of the zooecia, giving a forked shape to the proximal ends of the new individuals. *Bugula californica* is not as frequently recognized by collectors as is the reddish-brown *Bugula neritina*, and magni-

fication is required to recognize the distinctive taxonomic features. *B. californica* has not previously been identified from Hawaiian waters by other investigators, but it occurs repeatedly in the Bishop Museum collections.

The authors collected *B. californica* from floats and rafts at Kaneohe Bay, growing from the shaded undersides in 0.3-1.2 m depths of water, in July and August. It was also scraped in quantity from houseboats anchored in Ala Wai Yacht Basin. Museum data shows that specimens have been collected from December through June, but complete data is lacking on many of the 35 lots in which *B. californica* occurs; 25 lots are from Honolulu Harbor and the rest from Pearl Harbor. Also found in the University of Hawaii collections.

*Bugula californica* (Pl. 2, Fig. 1) ranges the eastern Pacific coastline from British Columbia to Mexico, the Gulf of California and the Galapagos Islands, in cool temperate to tropical waters. Also reported from Brazil (Osburn, 1950; Soule, 1959).

It seems possible that *Bugula pedata* Harmer, 1926, from the *Siboga* collections, may be synonymous with *Bugula californica* Robertson, 1905. Unfortunately Harmer had no locality data, and no ovicells were present on the single colony he had. The description of the two species are similar, and the method of branching is also; the axillary zooecium is immersed below the point of bifurcation like Harmer's Type 5 branching.

*Bugula neritina* (Pl. 2, Fig. 2). Perhaps the best known bryozoan, this species forms reddish-brown colonies prominent in many fouling communities. The zooecia are large, lightly calcified, and there are no avicularia. The ovicells are quite large, globose, and set at an angle at the distal end of the zooecium. *B. neritina* is common in Kaneohe Bay, on floats, rafts, and hulls from 0.3-1.2 m depths; also collected on glass slides in screened settling traps suspended at 3.05 m depths, during July and August. Quantities of *B. neritina* growing in extensive, branching colonies, were scraped from houseboats anchored in the Ala Wai Yacht Basin in Honolulu. It occurs in 66 lots of the Bishop Museum collections, taken about equally from Pearl Harbor, Honolulu Harbor and Kaneohe Bay. All months except January are represented. Also found in the University of Hawaii collections. *B. neritina* is distributed around the world in warm temperate to tropical waters.

*Hippopodina feegeensis*. An incrusting species, the colony formed is delicate and lightly calcified so that it may easily be overlooked. The calcified frontal is perforated by numerous pores, as is the ovicell which lies above the aperture. The aperture is hoof-shaped (hence the genus name of horse-footed), with straighter sides and an arcuate

proximal lip. The aperture rim is raised, and individuals are separated by ridges. Avicularia are long, triangular, and may be single or in pairs, pointing either distally or proximally, or they may be absent entirely over much of the colony.

*H. feegeensis* (Pl. 2, Fig. 3) has been identified by the authors for the first time in Hawaiian waters, scraped from the underside of a raft, at 0.3-1.2 m depths in Kaneohe Bay. It was also found in seven lots of Bishop Museum material, six taken from Honolulu Harbor and one from Kaneohe Bay. Not recorded from Pearl Harbor. A warm water species, *H. feegeensis* is actually a misnomer, the type specimen having come from the Philippine Islands, according to Hastings. It is also known from the Indo-Pacific and Atlantic, from Florida to Brazil. In the eastern Pacific it was collected once off Colombia, and found in southern California as a Pleistocene fossil (Harmer, 1957, Osburn, 1952, Soule and Soule, 1967).

*Savignyella lafonti* (Pl. 2, Fig. 4). A delicate, red, branching or spreading colony is formed showing uniserial series of zooecia with a joint between each individual. Dried colonies are white. The proximal end of the zooecium is imperforate and tubular; it widens into a trumpet shape bearing large frontal pores. The subterminal aperture is round, surrounded with six short spines. Ovicells are globular and perforated. *Savignyella lafonti* is inconspicuous, and since it loses its color soon after collecting, can easily be overlooked. Edmondson and Ingram discounted the species as a fouling organism, although it is stiff enough to give a certain rigidity to softer species with which it becomes entwined. Collected by the authors, it was common on floats and rafts in the shallow waters in Kaneohe Bay, and was frequently the initial colonizer on glass slides suspended in screened traps at 3.05 m depth. Also found intermixed with *Amathia*, *Zoobotryon*, and *Bowerbankia*. The species was identified from five lots in the Bishop Museum collections, from Pearl Harbor, Honolulu Harbor and Kaneohe Bay. *S. lafonti* is circumtropical in occurrence and is also found in warm temperate waters in the Atlantic and has been found in southern California harbors occasionally. (Harmer, 1957; Osburn, 1952).

*Schizoporella unicornis*. This species usually forms a flat crust over various surfaces, but may occasionally form branching, raised colonies. The zooecium frontal is perforate, the aperture has a median notch or sinus, and the avicularia, when present are never median. *S. unicornis* has a small tubercle (umbo) proximal to the sinus, and the avicularia are lateral to the aperture, paired or single. The ovicell is prominent and bears pores and ridges. On living material it is usually

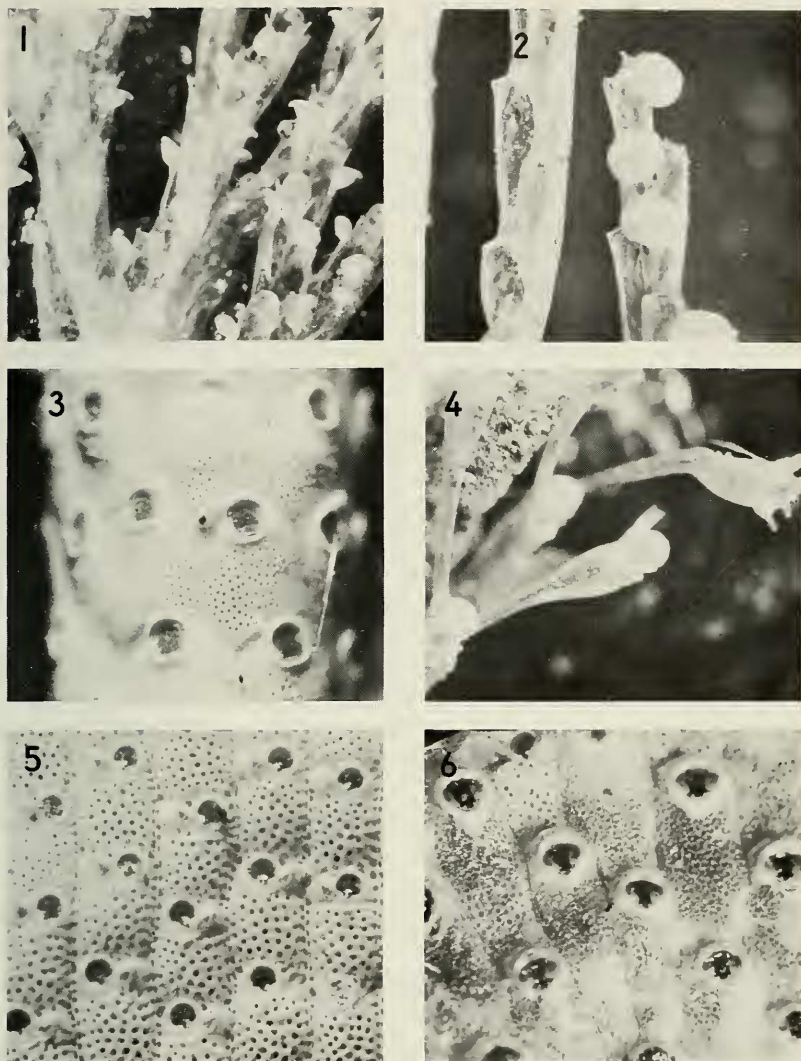


Plate 2.

Figure 1. *Bugula californica*, showing ovicells, corner spines and "bird's-head" avicularia.

Figure 2. *Bugula neritina*, with pointed distal corners, large ovicells set off-center.

Figure 3. *Hippopodina feegeensis*. Note hoof-shaped aperture, avicularium on center zooecium.

Figure 4. *Savignyella lafonti*, with trumpet-shaped individuals, ovicells distal to aperture.

Figure 5. *Schizoporella unicornis*. Aperture with proximal notch, lateral avicularia.

Figure 6. *Watersipora edmondsoni*, new species, showing mushroom-shaped opercular darkening, lateral cardelles (denticles) and tiny knobs at base of sinus notch.

necessary to remove the outer coating with bleach or by incineration in order to see the diagnostic features.

*S. unicornis* (Pl. 2, Fig. 5) was tentatively identified by Edmondson and Ingram (1939) as the incrusting species which is especially abundant in Kaneohe Bay, reproducing year round. They record a rapid rate of settling and colony growth. Edmondson (1944) diagrammed an ancestrula and the stages following settling, at Pearl Harbor. A brilliant orange, the live colonies are found on almost every substratum; glass, wood, shells, coral, and boat hulls. It is represented in the Bishop Museum collections in 14 lots, from Kaneohe Bay, Pearl Harbor, and Honolulu Harbor, and in the University of Hawaii collections. Also found by the authors on floating docks at Kaneohe Bay, 0.3-1.2 m depths, and at the Ala Wai Yacht Basin on boat hulls. The species is widely distributed in the western Atlantic from Nova Scotia to Brazil, the eastern Atlantic from Norway to South Africa; the Red Sea, Indo-Pacific, Japan, Queensland and the Loyalty Islands. Found also in southern California and the Gulf of California (Marcus, 1937; Osburn, 1952; Soule, 1961; Soule and Soule, 1964).

*Scrupocellaria sinuosa*. The colony is fragile, branched and whitish; it may be confused with *Bugula* in growth form, but magnification shows branches composed of segments of about seven zooecia, separated by light colored joints. There is a distinctive oval scute (shield), which arises at the side of the frontal membrane and arches out over it, with a branching pattern on the scute. Most species of *Scrupocellaria* have some type of scute. *S. sinuosa* has numerous avicularia, 3 or 4 small spines, and a few whips (vibracula) present. The dorsal side of the colony shows a sinuous line between adjacent zooecia, many rootlets. Ovicells bear large pores.

*Scrupocellaria sinuosa* (Pl. 1, Fig. 7) was first described from the island of Kauai, Hawaii by Canu and Bassler (1927). The colonies, though delicate and brittle, are sufficiently calcified to give rigidity in an aggregation of softer species. Found in one lot of Bishop Museum material, from Kawela Bay, northern Oahu, and in the University of Hawaii collections. Collected in small quantities by the authors at Kaneohe Bay. While *S. sinuosa* cannot be considered as a major fouling organism, it is worthy of note because it is the only species so far identified in the fouling community that appears to be endemic to Hawaii. Canu and Bassler (1927) pointed out several species with which it had some similarities, but there were important differences also. *S. sinuosa* does not fit precisely with any of Harmer's *Siboga* descriptions (1926) or with Osburn's Pacific coast species (1950).

*Watersipora edmondsoni*, new species.

## Plate 2, Figure 6

**Diagnosis:** Zoarium incrusting, reddish-brown to tan; growth usually unilaminar, subradial. Zooecia alternating, elongated when a single row widens into two rows. Aperture ovoid with a raised rim, a wide proximal notch and paired cardelles. Operculum with dark brown central pillar and distal rim areas; light areas on either side of pillar. Small white knobs on either side at base of pillar area. Frontal with large pores. No avicularia, no spines; no external ovicells.

**Description:** The zoaria form fan-shaped to discoidal unilaminar colonies 20-30 cm in diameter, growing out distolaterally from the ancestrula and later almost joining behind it. The marginal zooecia are somewhat raised and furled under. The disks of the colonies of *Watersipora edmondsoni* commonly had a colony of *Bugula californica* or *Savignyella lafonti* rooted in the aperture of the dead ancestrula and standing erect above the incrusting colony. Zooecia are distinct, separated, elongate, widest below the aperture, with numerous large pores in the frontal. The aperture is surrounded by a raised rim, sometimes with a slight distal keel, and a wide proximal notch or sinus. No external ovicells are found; the ovicells of *Watersipora* are endozooecial (internal at the proximal end of the zooecia). Zooecial dimensions vary: length  $1200\ \mu$  by  $400\ \mu$  wide to those measuring  $800\ \mu$  long and  $600\ \mu$  wide. Apertures varied from  $230\ \mu$  to  $260\ \mu$  in width, but the height of the aperture at the deepest part of the sinus was  $220\ \mu$  in all those measured.

The most distinctive feature of the new species is the operculum. In superficial examination of the colonies, the opercula stand out as dark brown, mushroom-shaped structures. The opercular are shaped like the aperture, ovoid and with a curved lower portion that fits into the sinus area. A dark, chitin-like central area, resembling a pillar or a mushroom stem, extends from the sinus distally, widening out at the upper edge of the operculum until it resembles a mushroom cap. This leaves lighter areas on either side of the stem. A thin chitinous rim circles the entire operculum, and a chitinous sclerite extends from each cardelle to the stem area. Two small white knobs flank the base of the stem.

*Watersipora edmondsoni* appeared in field collecting to be a *Schizoporella* sp. because of its orange color. When dry, it resembles *Watersipora cucullata* (Busk) 1854 in the appearance of the rows of zooecia. *W. cucullata* has been reported around the world in warmer waters. However Hastings (1930) noted that there are a number of differences in the opercula of specimens reported or collected from different areas

and she suggested that several species probably would be eventually distinguished. The operculum of *W. edmondsoni* most closely resembles Hasting's illustration of a specimen from Amoy, off China. Mawatari (1952) illustrated oriental specimens which also appear similar, but do not show sclerites of the same pattern as the new species or the exact pattern in the central chitinous portion of the operculum.

*Watersipora edmondsoni* was collected by the authors in quantity on houseboats in the Ala Wai Yacht Harbor, in Honolulu. In spite of the extensive collections of the Bishop Museum, no *Watersipora* has been previously reported in Hawaii. Most of the Bishop collecting was done between 1935 and 1956, and it seems to have been introduced and become established since that time. A similar situation was reported by Skerman (1960) in Auckland Harbor, New Zealand, where *Watersipora* had never been found on test panels until 1960.

*Holotype*: Allan Hancock Foundation Bryozoan No. 149.

*Zoobotryon verticillatum* [= *Z. pellucidus*] (Pl. 1, Fig. 15). A soft, branching translucent spaghetti-like colony is formed by *Zoobotryon*, which may be almost completely covered with silt and algae when collected. Zooecia are arranged bilaterally along the broad stolons, although they may occasionally occur in clusters. The zooecia do not spiral around the stolons as do *Amathia* sps. Individuals are saccate, with a blunt square distal tip and terminal aperture. The caudal end is attached directly and terminally to the stolon, whereas species of *Bowerbankia* are attached subterminally and have caudal projections on some zoids. *Z. verticillatum* was collected in Kaneohe Bay in July and August, from both floating and fixed docks, where it was hanging in great tangled streamers. It occurs in 15 lots of Bishop Museum material, collected from Pearl and Honolulu Harbors and Kaneohe Bay, in all months but February and March. Known to be circumtropical, it is also found in subtropical embayments (Osburn, 1953); reported from Hawaii by Robertson (1921).

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Accepted for publication September 6, 1968

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